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COMMITTEE OF EXPERTS ON THE TRANSPORT OF DANGEROUS GOODS

Sub-Committee of Experts on the Transport of Dangerous Goods
(Thirteenth session,
Geneva, 7-17 July 1997,
agenda item (3 (c))

DRAFT AMENDMENTS TO THE MODEL REGULATIONS ON THE TRANSPORT OF DANGEROUS GOODS

Other packaging and IBC matters

Large packagings

Transmitted by the Expert of the United Kingdom

During the Nineteenth Session of the Committee the proposal from Germany, Norway, Sweden and the United Kingdom submitted a revised proposal (see ST/SG/AC10/R522, R763) on large packagings.

The Committee made a number of detailed comments and it was agreed that an informal meeting would be held in London. The meeting was attended by the four co-sponsors and Spain, Japan, United States of America, ICIBCA and HMAC.

Following that meeting it was agreed that the sponsors would:

(1) Redraft the original Chapter X

(2) Modify the re-draft to enable it to be accommodated in the reformatted Recommendations.

(3) To underline the need for this type of packaging.

The work undertaken is reflected in the annexes to this document as follows:

Annex 1: The need for large packagings

Annex 2: Revised Chapter X (on te basis of the format of the 9th revised edition of the Recommendations)

Annex 3: Proposal to include Chapter X in the reformatted Recommendations (Amendments to 4.1.1.1 of the Model Regulations and new Chapter 6.6)
***Note**: Existing Chapter 6.6 would become Chapter 6.7.*

Further details and justification will be provided in a separate information paper.

Annex 1

The Need for Large Packagings

There are a range of products, articles and inner packagings which must be packaged and must be carried in large packagings.

1 The old Chapter 9 packagings (6.1) are limited to 450 litres or 400 kgs.

2 Large packagings are generally - but not exclusively - in the shape of boxes on pallet bases designed to exceed the limits in 1 above.

3 The old Chapter 16 (6.5) deals with IBCs which have a maximum capacity of 3000 litres 3 cu metres.

(a) There is no mass limit implying that IBCs were not intended for articles or inner packagings;

(b) The original CEFIC proposals of 1984 did not propose that IBCs should be used for anything other than bulk liquids or solids;

(c) The tests do not address inner packagings/articles unlike Chapter 9;

(d) The mark does not address inner packagings/articles;

(e) The requirements of 16.1.2.2.1, 16.1.3.3 and 16.2.1.1 only address solids or liquids.

4 Large packagings are in use in the following circumstances for the carriage of:

(a) Explosive articles particularly munitions;

(b) Batteries;

(c) Airbag kits;

(d) Clinical waste;

(e) Bulk supplies of chemicals in inner packagings which are not generally exempt.

Some illustrations are attached to show the items.

5 It has been argued that the existing provisions of Chapters 9 and 16 could be used. However there would be difficulties that may affect safety in transport.

If the packaging tests are adopted although drop and stack tests could be applied would they be sufficient? Large packagings will always be mechanically handled and there are no tests for handling. This would mean the provisions would need to be amended.

If the IBC tests are adopted these are more appropriate but as stated above there are no instructions concerning preparation for testing or identifying that the tests are appropriate through the mark. Again to address these problems, the text would need to be amended.

Amending the text of the existing packaging and IBC Chapters would mean a great deal of upheaval for well accepted text.

It is therefore proposed that a new Chapter is adopted.

Annex 2

Revised Chapter X as agreed in London - 28 February 1997
(on the basis of the structure of the 9th second edition of the Recommendations)

X1 Large Packagings

X1.1 Large Packagings are packagings consisting of an outer packaging which contains articles or inner packagings and which

(a) Are designed for mechanical handling;

(b) Exceed 400 kg net mass / 450 litres capacity but have a volume of not more than 3000 l / 3 m^3.

X1.3 The requirements of this Chapter do not apply to:

- class 2 except articles including aerosols,

- class 6.2 except clinical waste of UN 3291,

class 7 packages containing radioactive material, which should comply with the Regulations of the International Atomic Energy Agency (IAEA), except that:

(i) radioactive material possessing other dangerous properties (subsidiary risks) should also comply with special provision 172; and

(ii) low specific activity (LSA) material and surface contaminated objects (SCO) may be carried in certain packagings defined in these Recommendations provided that the supplementary provisions set out in the IAEA Regulations are also met.

X2 General packing requirements

X2.1 Large packagings should be of good quality. These should be constructed and closed so as to prevent the large packagings as prepared for transport from any loss of contents which might be caused under normal conditions of transport, by stresses produced in handling, by vibration, or by changes in temperature, humidity or pressure (resulting from altitude, for example). No harmful quantity of a dangerous substance should adhere to the outside of the large packagings. These provisions apply to both new and reused large packagings.

X2.2 Each large packagings should conform to a design type successfully tested in accordance with the requirements laid down in X5.

X2.3 New, reused or repaired large packagings should be capable of passing the tests prescribed in X5. Before being filled and handed over for transport, every large packagings should be inspected to ensure that it is free from corrosion, contamination or other damage. Any large packagings which shows signs of reduced strength as compared with the approved design type should no longer be used or should be so repaired that it is able to withstand the design type tests.

X2.4 Parts of inner packagings which are in direct contact with dangerous substances should not be affected by chemical or other action of those substances. Where necessary, they should be provided with a suitable inner coating or treatment. Such parts of packagings should not incorporate constituents liable to react dangerously with the contents so as to form hazardous products, or to weaken them significantly.

X2.5 When filling inner packagings with liquids, sufficient ullage (outage) should be left to ensure that neither leakage nor permanent distortion of the packaging occurs as a result of an expansion of the liquid caused by temperatures likely to occur during transport. Unless specific requirements are prescribed in national or international rules, agreements or recommendations, liquids should not completely fill a packaging at a temperature of 55 °C.

X2.6 For air transport, inner packagings intended to contain liquids should also be capable of withstanding a pressure differential without leakage as specified in the international regulations for air transport.

X2.7 Inner packagings should be packed in a large packagings in such a way that, under normal conditions of transport, they cannot break, be punctured or leak their contents into the large packagings. Inner packagings that are liable to break or be punctured easily, such as those made of glass, porcelain or stoneware or of certain plastics materials, etc., should be secured in the large packagings with suitable cushioning material. Any leakage of the contents should not substantially impair the protective properties of the cushioning material or of the large packagings.

X2.8 Dangerous goods should not be packed together in the same large packagings with dangerous or other goods if they react dangerously with each other and cause:

(a) combustion and/or evolution of considerable heat;
(b) evolution of flammable, toxic or asphyxiant gases;
(c) the formation of corrosive substances; or
(d) the formation of unstable substances.

X2.9 The closures of the inner packagings containing wetted or diluted substances should be such that the percentage of liquid (water, solvent or phlegma-tizer) does not fall below the prescribed limits during transport.

X2.10 Liquids may only be filled into packagings which have an appropriate resistance to internal pressure that may be developed under normal conditions of transport. Where pressure may develop in the packaging by the emission of gas from the contents (as a result of temperature increase or other cause), the packaging may be fitted with a vent, provided that the gas emitted will not cause danger on account of its toxicity, its flammability, the quantity released, etc. The vent should be so designed that, when the large packagings is in the attitude in which it is intended to be transported, leakages of liquid and the penetration of foreign substances are prevented under normal conditions of transport. Venting of the package should not be permitted for air transport.

X2.11 During carriage, large packagings should be securely fastened to or contained within the transport unit so as to prevent lateral or longitudinal movement or impact and so as to provide adequate external support.

X2.12 [If a large packagings has been contaminated, it should be treated in the same manner as is required by these Recommendations for a filled large packagings unless adequate measures have been taken to nullify any hazard.

X2.13 Where damaged or leaking packages are contaminated appropriate measures should be taken to prevent excessive movement of those packages within the large packagings. When the package contains liquids sufficient material should be added to the large packagings to absorb any free liquid.]

X2.14 Large packagings should be manufactured and tested under a quality assurance programme which satisfies the competent authority in order to ensure that each manufactured large packagings meets the requirements of this Chapter.

X3 *Marking*

X3.1 Primary marking. Each large packagings manufactured and intended for the use according to these Recommendations should bear durable and legible markings showing:

(a) The United Nations packaging symbol;

For metal large packagings on which the marking is stamped or embossed, the capital letters `UN` may be applied instead of the symbol;

(b) The code "50" designating a large rigid packaging or "51" for flexible large packagings, followed by the material type in accordance with 6.5.1.4.1(b);

(c) A capital letter designating the packing group(s) for which the design type has bee approved:

X for packing groups I, II and III
Y for packing groups II and III
Z for packing group III only;

(d) The month and year (last two digits) of manufacture;

(e) The State authorising the allocation of the mark; indicated by the distinguishing sign for motor vehicles in international traffic;

(f) The name or symbol of the manufacturer and other identification of the large packagings as specified by the competent authority;

(g) The stacking test load in kg. For large packagings not designed for stacking the figure "0" should be shown;

(h) The maximum permissible gross mass or for flexible large packagings the maximum permissible load.

The primary marking required above should be applied in the sequence of the sub-paragraphs.

Examples of the marking:

	50A/X/05 96/N/PQRS 2500/1000	For a large steel packaging stacking load. 2500 kg suitable for stacking, mass 1000 kg.
	50H/Y/04 95/D/ABCD 987 0/800	For a large plastics packaging not suitable for stacking, gross mass 800kg.
	51H/Z/0697/S/1999 0/500	For a large flexible packaging not suitable for stacking maximum gross mass 500 kg

X4 Specific Requirements for large packagings

X 4.1 *Specific requirements for metal*
50A 50B 50N

X4.1.1 Outer packaging should be made of suitable ductile metal in which the weldability has been fully demonstrated. Welds should be skillfully made and afford complete safety. Low-temperature performance should be taken into account when appropriate.

X4.1.2 Care should be taken to avoid damage by galvanic action due to the juxtaposition of dissimilar metals.

X4.2 *Specific requirements for flexible material*
51H 51M

X4.2.1 Outer packaging should be manufactured from suitable materials. The strength of the material and the construction of the flexible large packagings should be appropriate to its capacity and its intended use.

X4.2.2 All materials used in the construction of flexible large packagings of types 50M should, after complete immersion in water for not less than 24 hours, retain at least 85% of the tensile strength as measured originally on the material conditioned to equilibrium at 67% relative humidity or less.

X4.2.3 Seams should be formed by stitching, heat sealing, glueing or any equivalent method. All stitched seam-ends should be secured.

X4.2.4 Flexible large packagings should provide adequate resistance to ageing and to degradation caused by ultraviolet radiation or the climatic conditions, or by the substance contained, thereby rendering them appropriate to their intended use.

X4.2.5 For plastics flexible large packagings where protection against ultraviolet radiation is required, it should be provided by the addition of carbon black or other suitable pigments or inhibitors. These additives should be compatible with the contents and remain effective throughout the life of the outer packaging. Where use is made of carbon black, pigments or inhibitors other than those used in the manufacture of the tested design type, re-testing may be waived if changes in the carbon black content, the pigment content or the inhibitor content do not adversely affect the physical properties of the material of construction.

X4.2.6 Additives may be incorporated into the material of the outer packaging to improve the resistance to ageing or to serve other purposes, provided that these do not adversely affect the physical or chemical properties of the material.

X4.2.7 When filled, the ratio of height to width should be not more than 2:1.

X4.2.8 Where used a liner should be made of a suitable material. The strength of the material used and the construction of the liner should be appropriate to the capacity of the large packagings and the intended use. Joins and closures should be sift-proof and capable of withstanding pressures and impacts liable to occur under normal conditions of handling and transport.

X 4.3 *Specific requirements for Plastics*
50H

X.4.3.1 The outer packaging should be manufactured from suitable plastics material of known specifications and be of adequate strength in relation to its capacity and its intended use. The material should be adequately resistant to ageing and to degradation caused by the substance contained or, where relevant, by ultraviolet radiation. Low temperature performance should be taken into account when appropriate. Any permeation of the substance contained should not constitute a danger under normal conditions of transport.

X.4.3.2 Where protection against ultraviolet radiation is required, it should be provided by the addition of carbon black or other suitable pigments or inhibitors. These additives should be compatible with the contents and remain effective throughout the life of the outer packaging. Where use is made of carbon black, pigments or inhibitors other than those used in the manufacture of the tested design type, re-testing may be waived if changes in the carbon black content, the pigment content or the inhibitor content do not adversely affect the physical properties of the material of construction.

X.4.3.3 Additives may be incorporated in the material of the outer packaging to improve the resistance to ageing or to serve other purposes, provided that these do not adversely affect the physical or chemical properties of the material.

X.4.3.4 A relief device should be fitted to each large packagings intended for the transport of liquids, capable of releasing sufficient vapour to prevent the outer packaging of the large packagings from rupturing if it is subjected to an internal pressure in excess of that for which it was hydraulically tested. This can be achieved by conventional relief devices or by other means of construction.

X 4.4 *specific requirements for fibreboard*
50G

X 4 4.1 Strong and good quality solid or double-faced corrugated fibreboard (single or multiwall) should be used, appropriate to the capacity of the large packagings and to its intended use. The water resistance of the outer surface should be such that the increase in mass, as determined in a test carried out over a period of 30 minutes by the Cobb method of determining water absorption, is not greater than 155 g/m^2 - see ISO535:1991. It should have proper bending qualities. Fibreboard should be cut, creased without scoring, and slotted so as to permit assembly without cracking, surface breaks or undue bending. The fluting or corrugated fibreboard should be firmly glued to the facings.

X4.4.2 The walls, including top and bottom, should have a minimum puncture resistance of 15 J measured according to ISO 3036:1975.

X4.4.3 Manufacturing joins in the outer packaging of large packagings should be made with an appropriate overlap and should be taped, glued, stitched with metal staples or fastened by other means at least equally effective. Where joins are effected by gluing or taping, a water resistant adhesive should be used. Metal staples should pass completely through all pieces to be fastened and be formed or protected so that any inner liner cannot be abraded or punctured by them.

X 4.5 *specific requirements for wood*
50D 50C

X4.5.1 The strength of the materials used and the method of construction should be appropriate to the capacity and intended use of the large packagings.

X4.5.2 Natural wood should be well seasoned, commercially dry and free from defects that would materially lessen the strength of any part of the large packagings. Each part of the large packagings should consist of one piece or be equivalent thereto. Parts are considered equivalent to one piece when a suitable method of glued assembly is used as for instance Lindermann joint, tongue and groove joint, ship lap or rabbet joint; or butt joint with at least two corrugated metal fasteners at each joint, or when other methods at least equally effective are used.

X4.5.3 Outer packaging of plywood should be at least 3-ply. It should be made of well seasoned rotary cut, sliced or sawn veneer, commercially dry and free from defects that would materially lessen the strength of the outer packaging. All adjacent plies should be glued with water resistant adhesive. Other suitable materials may be used with plywood for the construction of the outer packaging.

X4.5.4 Outer packaging of reconstituted wood should be made of water resistant reconstituted wood such as hardboard, particle board or other suitable type.

X4.5.5 Large packagings should be firmly nailed or secured to corner posts or ends or be assembled by equally suitable devices.

X5 *Testing*

X5.1 Performance and frequency of test

X5.1.1 The design type of each large packagings should be tested as provided in X4.3 in accordance with procedures established by the competent authority.

X5.1.2 Tests should be successfully performed on each large packagings design type before such packaging is used. A large packagings design type is defined by the design, size, material and thickness, manner of construction and packing, but may include various surface treatments. It also includes large packagings which differ from the design type only in their lesser design height.

X5.1.3 Tests should be repeated on production samples at intervals established by the competent authority. For such tests on fibreboard large packagings, preparation at ambient conditions is considered equivalent to the provisions of 5.2.3.

X5.1.4 Tests should also be repeated after each modification which alters the design, material or manner of construction of a large packagings.

X5.1.5 The competent authority may permit the selective testing of large packagings that differ only in minor respects from a tested type, e.g. smaller sizes of inner packagings or inner packagings of lower net mass; and large packagings which are produced with small reductions in external dimension(s).

X5.1.6 Where a large packagings has been successfully tested with different types of inner packagings, a variety of such different inner packagings may also be assembled in this large packagings. In addition, provided an equivalent level of performance is maintained, the following variations in inner packagings are allowed without further testing of the package:

(a) Inner packagings of equivalent or smaller size may be used provided:

(i) The inner packagings are of similar design to the tested inner packagings (e.g. shape - round, rectangular, etc);

(ii) The material of construction of the inner packagings (glass, plastics, metal etc.) offers resistance to impact and stacking forces equal to or greater than that of the originally tested inner packaging; or

(iii) The inner packagings have the same or smaller openings and the closure is of similar design (e.g. screw cap, friction lid, etc);

(iv) Sufficient additional cushioning material is used to take up void spaces and to prevent significant movement of the inner packagings; and

(v) Inner packagings are oriented within the large packagings in the same manner as in the tested package;

(b) A lesser number of the tested inner packagings, or of the alternative types of inner packagings identified in (a) above, may be used provided sufficient cushioning is added to fill the void space(s) and to prevent significant movement of the inner packagings.

X5.1.7 The competent authority may at any time require proof, by tests in accordance with this section, that serially-produced large packagings meet the requirements of the design type tests.

X5.1.8 Provided the validity of the test results is not affected and with the approval of the competent authority, several tests may be made on one sample.

X5.2 *Preparation for testing*

X5.2.1 Tests should be carried out on large packagings prepared as for transport including the inner packagings or articles used. Inner packagings should be filled to not less than 98% of their maximum capacity for liquids or 95% for solids. For large packagings where the inner packagings are designed to carry liquids and solids, separate testing is required for both liquid and solid contents. The substances in the inner packagings or the articles to be transported in the large packagings may be replaced by other material or articles except where this would invalidate the results of the tests. When other inner packagings or articles are used they should have the same physical characteristics (mass, etc) as the inner packagings or articles to be carried. It is permissible to use additives, such as bags of lead shot, to achieve the requisite total package mass, so long as they are placed so that the test results are not affected.

X5.2.2 Large packagings made of plastics materials and large packagings containing inner packagings of plastic materials - other than bags intended to contain solids or articles - should be drop tested when the temperature of the test sample and its contents has been reduced to -18°C or lower. This conditioning may be disregarded if the materials in question are of sufficient ductility and tensile strength at low temperatures. Where test sample are prepared in this way, the conditioning in X5.2.3 may be waived. Test liquids should be kept in the liquid state by the addition of anti-freeze if necessary.

X5.2.3 Large packagings of fibreboard should be conditioned for at least 24 hours in an atmosphere having a controlled temperature and relative humidity (r.h). There are three options, one of which should be chosen.

The preferred atmosphere is 23 ± 2°C and 50% ± 2% r.h. The two other options are: 20 ± 2°C and 65% ± 2% r.h.; or 27 ± 2°C and 65% ± 2% r.h.

***Note**: Average values should fall within these limits. Short term fluctuations and measurement limitations may cause individual measurements to vary by up to ± 5% relative humidity without significant impairment of test reproducibility.*

X5.3 *Test requirements*

X5.3.1 *Bottom lift test*

X5.3.1.1 Applicability

For all types of large packagings which are fitted with means of lifting from the base, as a design type test.

X5.3.1.2 Preparation of large packagings for test.

The large packagings should be loaded to 1.25 times its maximum permissible gross mass, the load being evenly distributed.

X5.3.1.3 Method of testing

The large packagings should be raised and lowered twice by a lift truck with the forks centrally positioned and spaced at three quarters of the dimension of the side of entry (unless the points of entry are fixed). The forks should penetrate to three quarters of the direction of entry. The test should be repeated from each possible direction of entry.

X5.3.1.4 Criteria for passing the test

No permanent deformation which renders the large packagings unsafe for transport and no loss of contents.

X5.3.2 *Top lift test*

X5.3.2.1 Applicability

For types of large packagings which are intended to be lifted from the top and fitted with means of lifting, as a design type test.

X5.3.2.2 Preparation of large packagings for test

The large packagings should be loaded to twice its maximum permissible gross mass.

X5.3.2.3 Method of testing

The large packagings should be lifted in the manner for which it is designed until clear of the floor and maintained in that position for a period of five minutes.

X5.3.2.4 Criteria for passing the test

No permanent deformation which renders the large packagings unsafe for transport and no loss of contents.

X5.3.3 *Stacking test*

X5.3.3.1 Applicability

For all types of large packagings which are designed to be stacked on each other, as a design type test.

X5.3.3.2 Preparation of large packagings for test

The large packagings should be filled to its maximum permissible gross mass.

X5.3.3.3 Method of testing

The large packagings should be placed on its base on level hard ground and subjected to a uniformly distributed superimposed test load (see X5.3.3.4) for a period of at least five minutes, large packagings of wood, fibreboard and plastic materials for a period of 24 h.

X5.3.3.4 Calculation of superimposed test load

The load to be placed on the large packagings should be 1.8 times the combined maximum permissible gross mass of the number of similar large packagings that may be stacked on top of the large packagings during transport.

X5.3.3.5 Criteria for passing the test

No permanent deformation which renders the large packagings unsafe for transport and no loss of contents.

X5.3.4 *Drop test*

X5.3.4.1 Applicability

For all types of large packagings as a design type test.

X5.3.4.2 Preparation of large packagings for testing

The large packagings should be filled in accordance with X4.2.1

X5.3.4.3 Method of testing

The large packagings should be dropped onto a rigid, non-resilient, smooth, flat and horizontal surface, in such a manner as to ensure that the point of impact is that part of the base of the large packagings cnsidered to be the most vulnerable.

X5.3.4.4 Drop height

Packing Group I	**Packing Group II**	**Packing Group III**
1.8m	1.2m	0.8m

Where the substances to be transported have a relative density exceeding 1.2, the drop height should be calculated on the basis of the relative density (d) of the substance to be carried, rounded up to the first decimal, as follows:

Packing Group I	Packing Group II	Packing Group III
d x 1.5 (m)	d x 1.0 (m)	d x 0.67 (m)

X5.3.4.5 Criteria for passing the test

X5.3.4.5.1 The large packagings should not exhibit any damage liable to affect safety during transport. There should be no leakage of the filling substance from inner packaging(s) or article(s).

X5.3.4.5.2 No rupture is permitted in large packagings for articles of Class 1 which would permit the spillage of loose explosive substances or articles from the large packagings.

X5.3.4.5.3 Where a large packagings undergoes a drop test the sample passes the test if the entire contents are retained even if the closure is no longer sift-proof.

X5.4 Certification and test report

X5.4.1 In respect of each design type of large packagings a certificate and mark (as in X3) should be issued attesting that the design type including its equipment meets the test requirements.

5.4.2 A test report containing at least the following particulars should be drawn up and should be available to the users of the large packagings:

1 Name and address of the test facility;
2 Name and address of applicant (where appropriate);
3 A unique test report identification;
4 Date of the test report;
5 Manufacturer of the large packagings;
6 Description of the large packagings design type (e.g. dimensions, materials, closures, thickness, etc) and/or photograph(s)
7 Maximum capacity;
8 Characteristics of test contents, e.g. types and descriptions of inner packagings or articles used;
9 Test descriptions and results.
10 The test report should be signed with the name and status of the signatory.

5.4.3 The test report should contain statements that the large packagings prepared as for transport was tested in accordance with the appropriate provisions of chapter X and that the use of other packaging methods or components may render it invalid. A copy of the test report should be available to the competent authority.

Consequential Amendments to Chapter 4 Applicable to proposals 1, 2 or 3

4.8.2.1 Add a new second sentence:

"For the purpose of this subsection, the term packaging may also include the term large packagings (Chapter X) where appropriate."

4.8.2.4 Add a new second sentence:

"Where large packagings are used, they should meet the requirements of Chapter X and be tested in accordance with the provisions of Chapter X, Section 4.

4.8.2.17 Add a new sentence:

"EP02 may similarly be used for any article provided the large packagings has been approved by the national competent authority."

Annex 3

Proposal to include Chapter X in the new reformatted Recommendations

(Amendments to 4.1.1.1 and a new Chapter 6.6)

This proposal is based on ST/SG/AC.10/R.505 as amended during the Committee in December 1996.

The provisions of X2 are already included in 4.1.1 except as follows:

X.2.1 is the same as 4.1.1.1 except that the phrase "from any leakage" in the latter is replaced by "from any loss of contents in the former".

The original text can remain unchanged as "leakage" is not necessarily restricted in English to substance leakage.

X.2.2. = 4.1.1.3 but add after "6.1.5" "or 6.6.5"

X.2.3 = 4.1.1.9 but add after "6.1.5" "or 6.6.5"

X.2.4 = 4.1.1.2 - wording is slightly different but intent is the same, therefore no proposal to change

X.2.5 = 4.1.1.4

X.2.6 = 4.1.1.4.1

X.2.7 = 4.1.1.5

X.2.8 = 4.1.1.6

X..2.9 = 4.1.1.7

X.2.10 = No equivalent in 4.1.1. The group propose that this should be added as 4.1.1.15 (remembering subsequent paragraphs "X.2.10 here").

X.2.11 4.1.1.15 - During carriage, large packagings should be securely fastened to or contained within the transport unit so as to prevent lateral or longitudinal movement or impact and so as to provide adequate external support.

X.2.12 - X.2.13 No equivalent in 4.1.1. The group was divided on these points but is included in this proposal for consideration by the Sub-Committee. If adopted these would need to be 4.1.1.16 and 4.1.1.17 with subsequent renumbering of the following paragraphs:

4.1.1.16 [If a large packagings has been contaminated, it shall be treated in the same manner as is required by these Recommendations for a filled large packagings unless adequate measures have been taken to nullify any hazard.

4.1.1.17 Where damaged or leaking packages are contaminated appropriate measures shall be taken to prevent excessive movement of those packages within the large packagings. When the package contains liquid sufficient material shall be added to the large packagings to absorb any free liquid].

X.2.14 = 4.1.1.14

Add a new Chapter 6.6 as set out below.

Chapter 6.6 - Requirements for the Construction and Testing of Large Packagings

6.6.1 General

6.6.1.1 Large packagings are packagings consisting of an outer packaging which contains articles or inner packagings and which

(a) Are designed for mechanical handling;

(b) Exceed 400 kg net mass / 450 litres capacity but have a volume of not more than 3000 l /3 m^3.

The requirements of this Chapter do not apply to:

- Class 2 except articles including aerosols,

- Class 6.2 except clinical waste of UN 3291,

Class 7 packages containing radioactive material, which shall comply with the Regulations of the International Atomic Energy Agency (IAEA), except that:

(i) radioactive material possessing other dangerous properties (subsidiary risks) shall also comply with special provision 172; and

(ii) low specific activity (LSA) material and surface contaminated objects (SCO) must be carried in certain packagings defined in these Recommendations provided that the supplementary provisions set out in the IAEA Regulations are also met.

6.6.2 Code for Designating Types of Packagings

The codes used for large packagings consist of:

(a) Two Arabic numerals
50 for rigid large packagings
51 for flexible large packagings

(b) Capital letters in Latin characters indicating the nature of the material e.g. wood, steel etc. The capital letters used shall be those shown in 6.1.2.6.

6.6.3 Marking

6.6.3.1 Primary marking. Each large packaging manufactured and intended for the use according to these Recommendations shall bear durable and legible markings showing:

(a) The United Nations packaging symbol;

For metal large packagings on which the marking is stamped or embossed, the capital letters `UN` must be applied instead of the symbol;

(b) The code "50" designating a large rigid packaging or "51" for flexible large packagings, followed by the material type in accordance with 6.5.1.4.1(b);

(c) A capital letter designating the packing group(s) for which the design type has been approved:

X for packing groups I, II and III
Y for packing groups II and III
Z for packing group III only.

(d) The month and year (last two digits) of manufacture;

(e) The State authorising the allocation of the mark; indicated by the distinguishing sign for motor vehicles in international traffic;

(f) The name or symbol of the manufacturer and other identification of the large packagings as specified by the competent authority;

(g) The stacking test load in kg. For large packagings not designed for stacking the figure "0" shall be shown;

(h) The maximum permissible gross mass or for flexible large packagings the maximum permissible load.

The primary marking required above shall be applied in the sequence of the sub-paragraphs.

6.6.3.2 Examples of the marking:

50A/X/05 2500/1000	96/N/PQRS	For a large steel packaging stacking load. 2500kg suitable for stacking, mass 1000kg.

50H/Y/04 95/D/ABCD 987
0/800

For a large plastics packaging not suitable for stacking, gross mass 800kg.

51H/Z/0697/S/1999
0/500

For a large flexible packaging not suitable for
a large flexible packaging not suitable for stacking
maximum gross mass 500 kg.

6.6.4 Specific Requirements for large packagings

6.6.4.1 *specific requirements for metal*
50A 50B 50N

6.6.4.1.1 Outer packaging shall be made of suitable ductile metal in which the weldability has been fully demonstrated. Welds shall be skillfully made and afford complete safety. Low-temperature performance shall be taken into account when appropriate.

6.6.4.1.2 Care shall be taken to avoid damage by galvanic action due to the juxtaposition of dissimilar metals.

6.6.4.2 *specific requirements for flexible material*
51H 51M

6.6.4.2.1 Outer packaging shall be manufactured from suitable materials. The strength of the material and the construction of the flexible large packagings shall be appropriate to its capacity and its intended use.

6.6.4.2.2 All materials used in the construction of flexible large packagings of types 50M shall, after complete immersion in water for not less than 24 hours, retain at least 85% of the tensile strength as measured originally on the material conditioned to equilibrium at 67% relative humidity or less.

6.6.4.2.3 Seams shall be formed by stitching, heat sealing, glueing or any equivalent method. All stitched seam-ends shall be secured.

6.6.4.2.4 Flexible large packagings shall provide adequate resistance to ageing and to degradation caused by ultraviolet radiation or the climatic conditions, or by the substance contained, thereby rendering them appropriate to their intended use.

6.6.4.2.5 For plastics flexible large packagings where protection against ultraviolet radiation is required, it shall be provided by the addition of carbon black or other suitable pigments or inhibitors. These additives shall be compatible with the contents and remain effective throughout the life of the outer packaging. Where use is made of carbon black, pigments or inhibitors other than those used in the manufacture of the tested design type, re-testing must be waived if changes in the carbon black content, the pigment content or the inhibitor content do not adversely affect the physical properties of the material of construction.

6.6.4.2.6 Additives must be incorporated into the material of the outer packaging to improve the resistance to ageing or to serve other purposes, provided that these do not adversely affect the physical or chemical properties of the material.

6.6.4.2.7 When filled, the ratio of height to width shall be not more than 2:1.

6.6.4.2.8 Where used a liner shall be made of a suitable material. The strength of the material used and the construction of the liner shall be appropriate to the capacity of the large packagings and the intended use. Joins and closures shall be sift-proof and capable of withstanding pressures and impacts liable to occur under normal conditions of handling and transport.

6.6.4.3 *Specific requirements for Plastics*
50H

6.6.4.3.1 The outer packaging shall be manufactured from suitable plastics material of known specifications and be of adequate strength in relation to its capacity and its intended use. The material shall be adequately resistant to ageing and to degradation caused by the substance contained or, where relevant, by ultraviolet radiation. Low temperature performance shall be taken into account when appropriate. Any permeation of the substance contained shall not constitute a danger under normal conditions of transport.

6.6.4.3.2 Where protection against ultraviolet radiation is required, it shall be provided by the addition of carbon black or other suitable pigments or inhibitors. These additives shall be compatible with the contents and remain effective throughout the life of the outer packaging. Where use is made of carbon black, pigments or inhibitors other than those used in the manufacture of the tested design type, re-testing must be waived if changes in the carbon black content, the pigment content or the inhibitor content do not adversely affect the physical properties of the material of construction.

6.6.4.3.3 Additives must be incorporated in the material of the outer packaging to improve the resistance to ageing or to serve other purposes, provided that these do not adversely affect the physical or chemical properties of the material.

6.6.4.3.4 A relief device shall be fitted to each large packagings intended for the transport of liquids, capable of releasing sufficient vapour to prevent the outer packaging of the large packagings from rupturing if it is subjected to an internal pressure in excess of that for which it was hydraulically tested. This can be achieved by conventional relief devices or by other means of construction.

6.6.4.4 *Specific requirements for fibreboard*
50G

6.6.4 4.1 Strong and good quality solid or double-faced corrugated fibreboard (single or multiwall) shall be used, appropriate to the capacity of the large packagings and to its intended use. The water resistance of the outer surface shall be such that the increase in mass, as determined in a test carried out over a period of 30 minutes by the Cobb method of determining water absorption, is not greater than 155 g/m^2 - see ISO535:1991. It shall have proper bending qualities. Fibreboard shall be cut, creased without scoring, and slotted so as to permit assembly without cracking, surface breaks or undue bending. The fluting or corrugated fibreboard shall be firmly glued to the facings.

6.6.4.4.2 The walls, including top and bottom, shall have a minimum puncture resistance of 15 J measured according to ISO 3036:1975.

6.6.4.4.3 Manufacturing joins in the outer packaging of large packagings shall be made with an appropriate overlap and shall be taped, glued, stitched with metal staples or fastened by other means at least equally effective. Where joins are effected by gluing or taping, a water resistant adhesive shall be used. Metal staples shall pass completely through all pieces to be fastened and be formed or protected so that any inner liner cannot be abraded or punctured by them.

6.6.4.5 *specific requirements for wood*
50D 50C

6.6.4.5.1 The strength of the materials used and the method of construction shall be appropriate to the capacity and intended use of the large packagings.

6.6.4.5.2 Natural wood shall be well seasoned, commercially dry and free from defects that would materially lessen the strength of any part of the large packagings. Each part of the large packagings shall consist of one piece or be equivalent thereto. Parts are considered equivalent to one piece when a suitable method of glued assembly is used as for instance Lindermann joint, tongue and groove joint, ship lap or rabbet joint; or butt joint with at least two corrugated metal fasteners at each joint, or when other methods at least equally effective are used.

6.6.4.5.3 Outer packaging of plywood shall be at least 3-ply. It shall be made of well seasoned rotary cut, sliced or sawn veneer, commercially dry and free from defects that would materially lessen the strength of the outer packaging. All adjacent plies shall be glued with water resistant adhesive. Other suitable materials must be used with plywood for the construction of the outer packaging.

6.6.4.5.4 Outer packaging of reconstituted wood shall be made of water resistant reconstituted wood such as hardboard, particle board or other suitable type.

6.6.4.5.5 Large packagings shall be firmly nailed or secured to corner posts or ends or be assembled by equally suitable devices.

6.6.5 Test Requirements for Large Packagings

6.6.5.1 *Performance and frequency of test*

6.6.5.1.1 The design type of each large packagings shall be tested as provided in X4.3 in accordance with procedures established by the competent authority.

6.6.5.1.2 Tests shall be successfully performed on each large packagings design type before such packaging is used. A large packagings design type is defined by the design, size, material and thickness, manner of construction and packing, but must include various surface treatments. It also includes large packagings which differ from the design type only in their lesser design height.

6.6.5.1.3 Tests shall be repeated on production samples at intervals established by the competent authority. For such tests on fibreboard large packagings, preparation at ambient conditions is considered equivalent to the provisions of 6.6.5.2.3.

6.6.5.1.4 Tests shall also be repeated after each modification which alters the design, material or manner of construction of a large packagings.

6.6.5.1.5 The competent authority must permit the selective testing of large packagings that differ only in minor respects from a tested type, e.g. smaller sizes of inner packagings or inner packagings of lower net mass; and large packagings which are produced with small reductions in external dimension(s).

6.6.5.1.6 Where a large packagings has been successfully tested with different types of inner packagings, a variety of such different inner packagings must also be assembled in this large packagings. In addition, provided an equivalent level of performance is maintained, the following variations in inner packagings are allowed without further testing of the package:

(a) Inner packagings of equivalent or smaller size must be used provided:

(i) The inner packagings are of similar design to the tested inner packagings (e.g. shape - round, rectangular, etc);

(ii) The material of construction of the inner packagings (glass, plastics, metal etc.) offers resistance to impact and stacking forces equal to or greater than that of the originally tested inner packaging;

(iii) The inner packagings have the same or smaller openings and the closure is of similar design (e.g. screw cap, friction lid, etc);

(iv) Sufficient additional cushioning material is used to take up void spaces and to prevent significant movement of the inner packagings; and

(v) Inner packagings are oriented within the large packagings in the same manner as in the tested package.

(b) A lesser number of the tested inner packagings, or of the alternative types of inner packagings identified in (a) above, must be used provided sufficient cushioning is added to fill the void space(s) and to prevent significant movement of the inner packagings.

6.6.5.1.7 The competent authority must at any time require proof, by tests in accordance with this section, that serially-produced large packagings meet the requirements of the design type tests.

6.6.5.1.8 Provided the validity of the test results is not affected and with the approval of the competent authority, several tests must be made on one sample.

6.6.5.2 *Preparation for testing*

6.6.5.2.1 Tests shall be carried out on large packagings prepared as for transport including the inner packagings or articles used. Inner packagings shall be filled to not less than 98% of their maximum capacity for liquids or 95% for solids. For large packagings where the inner packagings are designed to carry liquids and solids, separate testing is required for both liquid and solid contents. The substances in the inner packagings or the articles to be transported in the large packagings must be replaced by other material or articles except where this would invalidate the results of the tests. When other inner packagings or articles are used they shall have the same physical characteristics (mass, etc) as the inner packagings or articles to be carried. It is permissible to use additives, such as bags of lead shot, to achieve the requisite total package mass, so long as they are placed so that the test results are not affected.

6.6.5.2.2 Large packagings made of plastics materials and large packagings containing inner packagings of plastic materials - other than bags intended to contain solids or articles - shall be drop tested when the temperature of the test sample and its contents has been reduced to -18°C or lower. This conditioning must be disregarded if the materials in question are of sufficient ductility and tensile strength at low temperatures. Where test sample are prepared in this way, the conditioning in 6.6.5.2.3 must be waived. Test liquids shall be kept in the liquid state by the addition of anti-freeze if necessary.

6.6.5.2.3 Large packagings of fibreboard shall be conditioned for at least 24 hours in an atmosphere having a controlled temperature and relative humidity (r.h). There are three options, one of which shall be chosen.

The preferred atmosphere is 23 ± 2°C and 50% ± 2% r.h. The two other options are: 20 ± 2°C and 65% ± 2% r.h.; or 27 ± 2°C and 65% ± 2% r.h.

Note: Average values shall fall within these limits. Short term fluctuations and measurement limitations must cause individual measurements to vary by up to ± 5% relative humidity without significant impairment of test reproducibility.

6.6.5.3 *Test requirements*

6.6.5.3.1 *Bottom lift test*

6.6.5.3.1.1 Applicability

For all types of large packagings which are fitted with means of lifting from the base, as a design type test.

6.6.5.3.1.2 Preparation of large packagings for test.

The large packagings shall be loaded to 1.25 times its maximum permissible gross mass, the load being evenly distributed.

6.6.5.3.1.3 Method of testing

The large packagings shall be raised and lowered twice by a lift truck with the forks centrally positioned and spaced at three quarters of the dimension of the side of entry (unless the points of entry are fixed). The forks shall penetrate to three quarters of the direction of entry. The test shall be repeated from each possible direction of entry.

6.6.5.3.1.4 Criteria for passing the test

No permanent deformation which renders the large packagings unsafe for transport and no loss of contents.

6.6.5.3.2 *Top lift test*

6.6.5.3.2.1 Applicability

For types of large packagings which are intended to be lifted from the top and fitted with means of lifting, as a design type test.

6.6.5.3.2.2 Preparation of large packagings for test

The large packagings shall be loaded to twice its maximum permissible gross mass.

6.6.5.3.2.3 Method of testing

The large packagings shall be lifted in the manner for which it is designed until clear of the floor and maintained in that position for a period of five minutes.

6.6.5.3.2.4 Criteria for passing the test

No permanent deformation which renders the large packagings unsafe for transport and no loss of contents.

6.6.5.3.3 *Stacking test*

6.6.5.3.3.1 Applicability

For all types of large packagings which are designed to be stacked on each other, as a design type test.

6.6.5.3.3.2 Preparation of large packagings for test

The large packagings shall be filled to its maximum permissible gross mass.

6.6.5.3.3.3 Method of testing

The large packagings shall be placed on its base on level hard ground and subjected to a uniformly distributed superimposed test load (see 6.6.5.3.3.4) for a period of at least five minutes, large packagings of wood, fibreboard and plastic materials for a period of 24 h.

6.6.5.3.3.4 Calculation of superimposed test load

The load to be placed on the large packagings shall be 1.8 times the combined maximum permissible gross mass of the number of similar large packagings that must be stacked on top of the large packagings during transport.

6.6.5.3.3.5 Criteria for passing the test

No permanent deformation which renders the large packagings unsafe for transport and no loss of contents.

6.6.5.3.4 *Drop test*

6.6.5.3.4.1 Applicability

For all types of large packagings as a design type test.

6.6.5.3.4.2 Preparation of large packagings for testing

The large packagings shall be filled in accordance with 6.6.4.2.1

6.6.5.3.4.3 Method of testing

The large packagings shall be dropped onto a rigid, non-resilient, smooth, flat and horizontal surface, in such a manner as to ensure that the point of impact is that part of the base of the large packagings considered to be the most vulnerable.

6.6.5.3.4.4 Drop height

Packing Group I	**Packing Group II**	**Packing Group III**
1.8m	1.2m	0.8m

Where the substances to be transported have a relative density exceeding 1.2, the drop height shall be calculated on the basis of the relative density (d) of the substance to be carried, rounded up to the first decimal, as follows:

Packing Group I	**Packing Group II**	**Packing Group III**
d x 1.5 (m)	d x 1.0 (m)	d x 0.67 (m)

6.6.5.3.4.5 Criteria for passing the test

6.6.5.3.4.5.1 The large packagings shall not exhibit any damage liable to affect safety during transport. There shall be no leakage of the filling substance from inner packaging(s) or article(s).

6.6.5.3.4.5.2 No rupture is permitted in large packagings for articles of Class 1 which would permit the spillage of loose explosive substances or articles from the large packagings.

6.6.5.3.4.5.3 Where a large packagings undergoes a drop test the sample passes the test if the entire contents are retained even if the closure is no longer sift-proof.

6.6.5.4 Certification and test report

6.6.5.4.1 In respect of each design type of large packagings a certificate and mark (as in X3) shall be issued attesting that the design type including its equipment meets the test requirements.

6.6.5.4.2 A test report containing at least the following particulars shall be drawn up and shall be available to the users of the large packagings:

1 Name and address of the test facility;
2 Name and address of applicant (where appropriate);
3 A unique test report identification;
4 Date of the test report;
5 Manufacturer of the large packagings;
6 Description of the large packagings design type (e.g. dimensions, materials, closures, thickness, etc) and/or photograph(s)
7 Maximum capacity;
8 Characteristics of test contents, e.g. types and descriptions of inner packagings or articles used;
9 Test descriptions and results.
10 The test report shall be signed with the name and status of the signatory.

6.6.5.4.3 The test report shall contain statements that the large packagings prepared as for transport was tested in accordance with the appropriate provisions of Chapter X and that the use of other packaging methods or components must render it invalid. A copy of the test report shall be available to the competent authority.

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COMMITTEE OF EXPERTS ON THE TRANSPORT OF DANGEROUS GOODS

Sub-Committee of Experts on the Transport of Dangerous Goods
(Thirteenth session,
Geneva, 7-17 July 1997,
agenda item (3 (c))

DRAFT AMENDMENTS TO THE MODEL REGULATIONS ON THE TRANSPORT OF DANGEROUS GOODS

Other packaging and IBC matters

Large packagings

Revision 1

Transmitted by the Expert of the United Kingdom

During the Nineteenth Session of the Committee Germany, Norway, Sweden and the United Kingdom submitted a revised proposal (see ST/SG/AC10/R522, R763) on large packagings.

The Committee made a number of detailed comments and experts were invited to submit written comments by 31 January 1997 to the expert from the United Kingdom for inclusion in a revised draft proposal to be discussed at an informal meeting to be held in London on 28 February 1997. That meeting was attended by the four co-sponsors and experts from Spain, Japan, United States of America, ICIBCA and HMAC.

Following that meeting it was agreed that the sponsors would:

(1) Redraft the original Chapter X

(2) Modify the re-draft to enable it to be accommodated in the reformatted Recommendations.

(3) Clarify the need for addressing this type of packaging.

The Need for Large Packagings

There is a range of products, articles and inner packagings which must be packaged and must be carried in large packagings.

1. Packagings of the former Chapter 9 (new 6.1) are limited to 450 litres or 400 kgs.

2. Large packagings are generally - but not exclusively - in the shape of boxes on pallet bases designed to exceed the limits in 1 above. However, some articles particularly in Class 1 may not be in a box-like shape.

3. Packagings of the former Chapter 16 (new 6.5) which are IBCs with a maximum capacity of 3000 litres 3 cu metres.

(a) There is no mass limit set for IBCs implying that they were not intended for articles or inner packagings. This was not clear in the original proposals;

(b) The original CEFIC proposals of 1984 did not propose that IBCs should be used for anything other than bulk liquids or solids;

(c) The tests do not address inner packagings/articles unlike those in Chapter 9 (6.1);

(d) The mark does not address inner packagings/articles;

(e) The requirements of 16.1.2.2.1, 16.1.3.3. and 16.1.3.4 only address solids or liquids (new 6.5.1.4.1, 6.5.1.5.3, 6.5.1.5.4).

4. Large packagings are already commonly in use in the following circumstances for the carriage of :

(a) Explosive articles particularly munitions;

(b) Batteries;

(c) Airbag kits;

(d) Packaged clinical waste;

(e) Bulk supplies of chemicals in inner packagings which are not generally exempt from current UN provisions. There is a need to send larger inner packagings in significant quantities of substances (often for consumer use) which would not meet the requirements of the limited quantity provisions eg to warehouses. Having regard to the current environmental impetus to minimise packaging it is also more economic to use large packagings;

(f) Packaged dangerous wastes. During the meeting in London a number of experts expressed concerns that large packagings should be specifically available for the transport of dangerous wastes. The use of such packagings is common practice and the need for them is therefore essential in Europe. There were some reservations in the Working Group concerning the reference to this in the Recommendations. Whatever the outcome of the Sub-Committee discussion, the modal bodies will have to consider how to address this requirement.

Some illustrations of current large packagings in use are attached to indicate their general characteristics.

5. It has been argued that large packagings could be addressed within the existing provisions of Chapters 9 and 16. However there would be practical difficulties resulting that may affect safety in transport.

Large packagings are handled, loaded and unloaded and secured in the same manner as IBCs and not like packagings. Therefore, the IBC test programme is more appropriate to large packagings. For the test programme comparable to IBCs it is only necessary to have one or two samples but for the drop test in the packaging regime five or six samples are needed depending on the form and design of the packaging. This is very cost effective and not done for IBCs of similar size.

If the packaging tests were to be adopted the drop and stack tests could be applied but are unlikely to be sufficient. Large packagings will always be mechanically handled and there are no tests for handling. This would mean the provisions would need to be amended.

The IBC tests might be adopted as stated above there are no instructions concerning preparation for testing or identifying that the tests are appropriate through the mark. Again to address these problems, the existing IBC test text would need to be amended.

Amending the text of the existing packaging and IBC Chapters would mean a great deal of upheaval and redrafting for well accepted text in order to address a unique packaging type.

It is therefore proposed that a new Chapter as previously proposed is adopted.

Annex A

Revised Chapter X as agreed in London - 28 February 1997

X1 Large Packagings

X1.1 Large Packagings are packagings consisting of an outer packaging which contains articles or inner packagings and which

(a) Are designed for mechanical handling;

(b) Exceed 400 kg net mass / 450 litres capacity but have a volume of not more than 3000 l / 3 m^3.

X1.2 The requirements of this Chapter do not apply to:

- Class 2 except articles including aerosols,

- Class 6.2 except clinical waste of UN 3291,

Class 7 packages containing radioactive material, which should comply with the Regulations of the International Atomic Energy Agency (IAEA), except that:

(i) radioactive material possessing other dangerous properties (subsidiary risks) should also comply with special provision 172; and

(ii) low specific activity (LSA) material and surface contaminated objects (SCO) may be carried in certain packagings defined in these Recommendations provided that the supplementary provisions set out in the IAEA Regulations are also met.

X2 General packing requirements

X2.1 Large packagings should be of good quality. These should be constructed and closed so as to prevent the large packagings as prepared for transport from any loss of contents which might be caused under normal conditions of transport, by stresses produced in handling, by vibration, or by changes in temperature, humidity or pressure (resulting from altitude, for example). No harmful quantity of a dangerous substance should adhere to the outside of the large packagings. These provisions apply to both new and reused large packagings.

X2.2 Each large packagings should conform to a design type successfully tested in accordance with the requirements laid down in X5.

X2.3 New, reused or repaired large packagings should be capable of passing the tests prescribed in X5. Before being filled and handed over for transport, every large packagings should be inspected to ensure that it is free from corrosion, contamination or other damage. Any large packagings which shows signs of reduced strength as compared with the approved design type should no longer be used or should be so repaired that it is able to withstand the design type tests.

X2.4 Parts of inner packagings which are in direct contact with dangerous substances should not be affected by chemical or other action of those substances. Where necessary, they should be provided with a suitable inner coating or treatment. Such parts of packagings should not incorporate constituents liable to react dangerously with the contents so as to form hazardous products, or to weaken them significantly.

X2.5 When filling inner packagings with liquids, sufficient ullage (outage) should be left to ensure that neither leakage nor permanent distortion of the packaging occurs as a result of an expansion of the liquid caused by temperatures likely to occur during transport. Unless specific requirements are prescribed in national or international rules, agreements or recommendations, liquids should not completely fill a packaging at a temperature of 55 °C.

X2.6 For air transport, inner packagings intended to contain liquids should also be capable of withstanding a pressure differential without leakage as specified in the international regulations for air transport.

X2.7 Inner packagings should be packed in a large packagings in such a way that, under normal conditions of transport, they cannot break, be punctured or leak their contents into the large packagings. Inner packagings that are liable to break or be punctured easily, such as those made of glass, porcelain or stoneware or of certain plastics materials, etc., should be secured in the large packagings with suitable cushioning material. Any leakage of the contents should not substantially impair the protective properties of the cushioning material or of the large packagings.

X2.8 Dangerous goods should not be packed together in the same large packagings with dangerous or other goods if they react dangerously with each other and cause:

(a) combustion and/or evolution of considerable heat;
(b) evolution of flammable, toxic or asphyxiant gases;
(c) the formation of corrosive substances; or
(d) the formation of unstable substances.

X2.9 The closures of the inner packagings containing wetted or diluted substances should be such that the percentage of liquid (water, solvent or phlegma-tizer) does not fall below the prescribed limits during transport.

X2.10 Liquids may only be filled into inner packagings which have an appropriate resistance to internal pressure that may be developed under normal conditions of transport. Where pressure may develop in the packaging by the emission of gas from the contents (as a result of temperature increase or other cause), the packaging may be fitted with a vent, provided that the gas emitted will not cause danger on account of its toxicity, its flammability, the quantity released, etc. The vent should be so designed that, when the large packagings is in the attitude in which it is intended to be transported, leakages of liquid and the penetration of foreign substances are prevented under normal conditions of transport. Venting of the package should not be permitted for air transport.

X2.11 During carriage, large packagings should be securely fastened to or contained within the transport unit so as to prevent lateral or longitudinal movement or impact and so as to provide adequate external support.

X2.12 [If a large packagings has been contaminated, it should be treated in the same manner as is required by these Recommendations for a filled large packagings unless adequate measures have been taken to nullify any hazard.

X2.13 Where damaged or leaking packages are contaminated appropriate measures should be taken to prevent excessive movement of those packages within the large packagings. When the package contains liquids sufficient material should be added to the large packagings to absorb any free liquid.]

X2.14 Large packagings should be manufactured and tested under a quality assurance programme which satisfies the competent authority in order to ensure that each manufactured large packagings meets the requirements of this Chapter.

X3 *Marking*

X3.1 Primary marking. Each large packagings manufactured and intended for the use according to these Recommendations should bear durable and legible markings showing:

(a) The United Nations packaging symbol

For metal large packagings on which the marking is stamped or embossed, the capital letters `UN` may be applied instead of the symbol;

(b) The code "50" designating a large rigid packaging or "51" for flexible large packagings, followed by the material type in accordance with 6.5.1.4.1(b);

(c) A capital letter designating the packing group(s) for which the design type has bee approved:

X for packing groups I, II and III
Y for packing groups II and III
Z for packing group III only;

(d) The month and year (last two digits) of manufacture;

(e) The State authorising the allocation of the mark; indicated by the distinguishing sign for motor vehicles in international traffic;

(f) The name or symbol of the manufacturer and other identification of the large packagings as specified by the competent authority;

(g) The stacking test load in kg. For large packagings not designed for stacking the figure "0" should be shown;

(h) The maximum permissible gross mass or for flexible large packagings the maximum permissible load.

The primary marking required above should be applied in the sequence of the sub-paragraphs.

Examples of the marking:

	50 A/X/05 2500/1000	96/N/PQRS	For a large steel packaging stacking load. 2500kg suitable for stacking mass1000kg.
	50 H/Y/04 0/800	95/D/ABCD 987	For a large plastics packaging not suitable for stacking, gross mass 800kg.
	51H/Z/0697/S/1999 0/500		For a large flexible packaging not suitable for stacking maximum gross mass 500 kg.

X4 Specific Requirements for large packagings

X 4.1 *Specific requirements for metal*
50A 50B 50N

X4.1.1 Outer packaging should be made of suitable ductile metal in which the weldability has been fully demonstrated. Welds should be skillfully made and afford complete safety. Low-temperature performance should be taken into account when appropriate.

X4.1.2 Care should be taken to avoid damage by galvanic action due to the juxtaposition of dissimilar metals.

X4.2 *Specific requirements for flexible material*
51H 51M

X4.2.1 Outer packaging should be manufactured from suitable materials. The strength of the material and the construction of the flexible large packagings should be appropriate to its capacity and its intended use.

X4.2.2 All materials used in the construction of flexible large packagings of types 50M should, after complete immersion in water for not less than 24 hours, retain at least 85% of the tensile strength as measured originally on the material conditioned to equilibrium at 67% relative humidity or less.

X4.2.3 Seams should be formed by stitching, heat sealing, glueing or any equivalent method. All stitched seam-ends should be secured.

X4.2.4 Flexible large packagings should provide adequate resistance to ageing and to degradation caused by ultraviolet radiation or the climatic conditions, or by the substance contained, thereby rendering them appropriate to their intended use.

X4.2.5 For plastics flexible large packagings where protection against ultraviolet radiation is required, it should be provided by the addition of carbon black or other suitable pigments or inhibitors. These additives should be compatible with the contents and remain effective throughout the life of the outer packaging. Where use is made of carbon black, pigments or inhibitors other than those used in the manufacture of the tested design type, re-testing may be waived if changes in the carbon black content, the pigment content or the inhibitor content do not adversely affect the physical properties of the material of construction.

X4.2.6 Additives may be incorporated into the material of the outer packaging to improve the resistance to ageing or to serve other purposes, provided that these do not adversely affect the physical or chemical properties of the material.

X4.2.7 When filled, the ratio of height to width should be not more than 2:1.

X4.2.8 Where used a liner should be made of a suitable material. The strength of the material used and the construction of the liner should be appropriate to the capacity of the large packagings and the intended use. Joins and closures should be sift-proof and capable of withstanding pressures and impacts liable tc occur under normal conditions of handling and transport.

X 4.3 *Specific requirements for Plastics*
50H

X.4.3.1 The outer packaging should be manufactured from suitable plastics material of known specifications and be of adequate strength in relation to its capacity and its intended use. The material should be adequately resistant to ageing and to degradation caused by the substance contained or, where relevant, by ultraviolet radiation. Low temperature performance should be taken into account when appropriate. Any permeation of the substance contained should not constitute a danger under normal conditions of transport.

X.4.3.2 Where protection against ultraviolet radiation is required, it should be provided by the addition of carbon black or other suitable pigments or inhibitors. These additives should be compatible with the contents and remain effective throughout the life of the outer packaging. Where use is made of carbon black, pigments or inhibitors other than those used in the manufacture of the tested design type, re-testing may be waived if changes in the carbon black content, the pigment content or the inhibitor content do not adversely affect the physical properties of the material of construction.

X.4.3.3 Additives may be incorporated in the material of the outer packaging to improve the resistance to ageing or to serve other purposes, provided that these do not adversely affect the physical or chemical properties of the material.

X.4.3.4 A relief device should be fitted to each large packagings intended for the transport of liquids, capable of releasing sufficient vapour to prevent the outer packaging of the large packagings from rupturing if it is subjected to an internal pressure in excess of that for which it was hydraulically tested. This can be achieved by conventional relief devices or by other means of construction.

X 4.4 *Specific requirements for fibreboard*
50G

X 4 4.1 Strong and good quality solid or double-faced corrugated fibreboard (single or multiwall) should be used, appropriate to the capacity of the large packagings and to its intended use. The water resistance of the outer surface should be such that the increase in mass, as determined in a test carried out over a period of 30 minutes by the Cobb method of determining water absorption, is not greater than 155 g/m² - see ISO535:1991. It should have proper bending qualities. Fibreboard should be cut, creased without scoring, and slotted so as to permit assembly without cracking, surface breaks or undue bending. The fluting or corrugated fibreboard should be firmly glued to the facings.

X4.4.2 The walls, including top and bottom, should have a minimum puncture resistance of 15 J measured according to ISO 3036:1975.

X4.4.3 Manufacturing joins in the outer packaging of large packagings should be made with an appropriate overlap and should be taped, glued, stitched with metal staples or fastened by other means at least equally effective. Where joins are effected by gluing or taping, a water resistant adhesive should be used. Metal staples should pass completely through all pieces to be fastened and be formed or protected so that any inner liner cannot be abraded or punctured by them.

X 4.5 *Specific requirements for wood*
50D 50C

X4.5.1 The strength of the materials used and the method of construction should be appropriate to the capacity and intended use of the large packagings.

X4.5.2 Natural wood should be well seasoned, commercially dry and free from defects that would materially lessen the strength of any part of the large packagings. Each part of the large packagings should consist of one piece or be equivalent thereto. Parts are considered equivalent to one piece when a suitable method of glued assembly is used as for instance Lindermann joint, tongue and groove joint, ship lap or rabbet joint; or butt joint with at least two corrugated metal fasteners at each joint, or when other methods at least equally effective are used.

X4.5.3 Outer packaging of plywood should be at least 3-ply. It should be made of well seasoned rotary cut, sliced or sawn veneer, commercially dry and free from defects that would materially lessen the strength of the outer packaging. All adjacent plies should be glued with water resistant adhesive. Other suitable materials may be used with plywood for the construction of the outer packaging.

X4.5.4 Outer packaging of reconstituted wood should be made of water resistant reconstituted wood such as hardboard, particle board or other suitable type.

X4.5.5 Large packagings should be firmly nailed or secured to corner posts or ends or be assembled by equally suitable devices.

X5 *Testing*

X5.1 Performance and frequency of test

X5.1.1 The design type of each large packagings should be tested as provided in X4.3 in accordance with procedures established by the competent authority.

X5.1.2 Tests should be successfully performed on each large packagings design type before such packaging is used. A large packagings design type is defined by the design, size, material and thickness, manner of construction and packing, but may include various surface treatments. It also includes large packagings which differ from the design type only in their lesser design height.

X5.1.3 Tests should be repeated on production samples at intervals established by the competent authority. For such tests on fibreboard large packagings, preparation at ambient conditions is considered equivalent to the provisions of 5.2.3.

X5.1.4 Tests should also be repeated after each modification which alters the design, material or manner of construction of a large packagings.

X5.1.5 The competent authority may permit the selective testing of large packagings that differ only in minor respects from a tested type, e.g. smaller sizes of inner packagings or inner packagings of lower net mass; and large packagings which are produced with small reductions in external dimension(s).

X5.1.6 Where a large packagings has been successfully tested with different types of inner packagings, a variety of such different inner packagings may also be assembled in this large packagings. In addition, provided an equivalent level of performance is maintained, the following variations in inner packagings are allowed without further testing of the package:

(a) Inner packagings of equivalent or smaller size may be used provided:

(i) The inner packagings are of similar design to the tested inner packagings (e.g. shape - round, rectangular, etc);

(ii) The material of construction of the inner packagings (glass, plastics, metal etc.) offers resistance to impact and stacking forces equal to or greater than that of the originally tested inner packaging;

(iii) The inner packagings have the same or smaller openings and the closure is of similar design (e.g. screw cap, friction lid, etc);

(iv) Sufficient additional cushioning material is used to take up void spaces and to prevent significant movement of the inner packagings; and

(v) Inner packagings are oriented within the large packagings in the same manner as in the tested package;

(b) A lesser number of the tested inner packagings, or of the alternative types of inner packagings identified in (a) above, may be used provided sufficient cushioning is added to fill the void space(s) and to prevent significant movement of the inner packagings.

X5.1.7 The competent authority may at any time require proof, by tests in accordance with this section, that serially-produced large packagings meet the requirements of the design type tests.

X5.1.8 Provided the validity of the test results is not affected and with the approval of the competent authority, several tests may be made on one sample.

X5.2 *Preparation for testing*

X5.2.1 Tests should be carried out on large packagings prepared as for transport including the inner packagings or articles used. Inner packagings should be filled to not less than 98% of their maximum capacity for liquids or 95% for solids. For large packagings where the inner packagings are designed to carry liquids and solids, separate testing is required for both liquid and solid contents. The substances in the inner packagings or the articles to be transported in the large packagings may be replaced by other material or articles *except where this would* invalidate the results of the tests. When other inner packagings or articles are used they should

have the same physical characteristics (mass, etc) as the inner packagings or articles to be carried. It is permissible to use additives, such as bags of lead shot, to achieve the requisite total package mass, so long as they are placed so that the test results are not affected.

X5.2.2 Large packagings made of plastics materials and large packagings containing inner packagings of plastic materials - other than bags intended to contain solids or articles - should be drop tested when the temperature of the test sample and its contents has been reduced to -18°C or lower. This conditioning may be disregarded if the materials in question are of sufficient ductility and tensile strength at low temperatures. Where test sample are prepared in this way, the conditioning in X5.2.3 may be waived. Test liquids should be kept in the liquid state by the addition of anti-freeze if necessary.

X5.2.3 Large packagings of fibreboard should be conditioned for at least 24 hours in an atmosphere having a controlled temperature and relative humidity (r.h). There are three options, one of which should be chosen.

The preferred atmosphere is 23 ± 2°C and 50% ± 2% r.h. The two other options are: 20 ± 2°C and 65% ± 2% r.h.; or 27 ± 2°C and 65% ± 2% r.h.

***Note**: Average values should fall within these limits. Short term fluctuations and measurement limitations may cause individual measurements to vary by up to ± 5% relative humidity without significant impairment of test reproducibility.*

X5.3 *Test requirements*

X5.3.1 *Bottom lift test*

X5.3.1.1 Applicability

For all types of large packagings which are fitted with means of lifting from the base, as a design type test.

X5.3.1.2 Preparation of large packagings for test.

The large packagings should be loaded to 1.25 times its maximum permissible gross mass, the load being evenly distributed.

X5.3.1.3 Method of testing

The large packagings should be raised and lowered twice by a lift truck with the forks centrally positioned and spaced at three quarters of the dimension of the side of entry (unless the points of entry are fixed). The forks should penetrate to three quarters of the direction of entry. The test should be repeated from each possible direction of entry.

X5.3.1.4 Criteria for passing the test

No permanent deformation which renders the large packagings unsafe for transport and no loss of contents.

X5.3.2 *Top lift test*

X5.3.2.1 Applicability

For types of large packagings which are intended to be lifted from the top and fitted with means of lifting, as a design type test.

X5.3.2.2 Preparation of large packagings for test

The large packagings should be loaded to twice its maximum permissible gross mass.

X5.3.2.3 Method of testing

The large packagings should be lifted in the manner for which it is designed until clear of the floor and maintained in that position for a period of five minutes.

X5.3.2.4 Criteria for passing the test

No permanent deformation which renders the large packagings unsafe for transport and no loss of contents.

X5.3.3 *Stacking test*

X5.3.3.1 Applicability

For all types of large packagings which are designed to be stacked on each other, as a design type test.

X5.3.3.2 Preparation of large packagings for test

The large packagings should be filled to its maximum permissible gross mass.

X5.3.3.3 Method of testing

The large packagings should be placed on its base on level hard ground and subjected to a uniformly distributed superimposed test load (see X5.3.3.4) for a period of at least five minutes, large packagings of wood, fibreboard and plastic materials for a period of 24 h.

X5.3.3.4 Calculation of superimposed test load

The load to be placed on the large packagings should be 1.8 times the combined maximum permissible gross mass of the number of similar large packagings that may be stacked on top of the large packagings during transport.

X5.3.3.5 Criteria for passing the test

No permanent deformation which renders the large packagings unsafe for transport and no loss of contents.

X5.3.4 *Drop test*

X5.3.4.1 Applicability

For all types of large packagings as a design type test.

X5.3.4.2 Preparation of large packagings for testing

The large packagings should be filled in accordance with X4.2.1

X5.3.4.3 Method of testing

The large packagings should be dropped onto a rigid, non-resilient, smooth, flat and horizontal surface, in such a manner as to ensure that the point of impact is that part of the base of the large packagings cnsidered to be the most vulnerable.

X5.3.4.4 Drop height

Packing Group I	**Packing Group II**	**Packing Group III**
1.8m	1.2m	0.8m

Where the substances to be transported have a relative density exceeding 1.2, the drop height should be calculated on the basis of the relative density (d) of the substance to be carried, rounded up to the first decimal, as follows:

Packing Group I	**Packing Group II**	**Packing Group III**
d × 1.5 (m)	d × 1.0 (m)	d × 0.67 (m)

X5.3.4.5 Criteria for passing the test

X5.3.4.5.1 The large packagings should not exhibit any damage liable to affect safety during transport. There should be no leakage of the filling substance from inner packaging(s) or article(s).

X5.3.4.5.2 No rupture is permitted in large packagings for articles of Class 1 which would permit the spillage of loose explosive substances or articles from the large packagings.

X5.3.4.5.3 Where a large packagings undergoes a drop test the sample passes the test if the entire contents are retained even if the closure is no longer sift-proof.

X5.4 Certification and test report

X5.4.1 In respect of each design type of large packagings a certificate and mark (as in X3) should be issued attesting that the design type including its equipment meets the test requirements.

5.4.2 A test report containing at least the following particulars should be drawn up and should be available to the users of the large packagings:

1 Name and address of the test facility;
2 Name and address of applicant (where appropriate);
3 A unique test report identification;
4 Date of the test report;
5 Manufacturer of the large packagings;
6 Description of the large packagings design type (e.g. dimensions, materials, closures, thickness, etc) and/or photograph(s);
7 Maximum capacity;
8 Characteristics of test contents, e.g. types and descriptions of inner packagings or articles used;
9 Test descriptions and results;
10 The test report should be signed with the name and status of the signatory.

5.4.3 The test report should contain statements that the large packagings prepared as for transport was tested in accordance with the appropriate provisions of chapter X and that the use of other packaging methods or components may render it invalid. A copy of the test report should be available to the competent authority.

Further consequential amendments to Chapter 4 to address Class 1 matters

Add a new 2nd sentence to 4.1.3.1 as follows: For the purpose of this subsection, the term packaging may also include the term large packagings (Chapter X - Part 6.6) where appropriate.

Add a new 2nd sentence to 4.1.3.5 as follows - Where large packagings are used, they should meet the requirements of Chapter X and be tested in accordance with the provisions of Chapter X (6.6) Section 5 (6.65).

Annex B

Proposal to include Chapter X in the new reformatted Recommendations

(Amendments to 4.1.1.1 and a new Section 6.6)

This proposal is based on ST/SG/AC.10/R.505 as amended during the Committee in December 1996.

The provisions of X2 are already included in 4.1.1 except as follows:

X.2.1 is the same as 4.1.1.1 except that the phrase "from any leakage" in the latter is replaced by "from any loss of contents in the former".

The original text can remain unchanged as "leakage" is not necessarily restricted in English to substance leakage.

X.2.2. = 4.1.1.3 but add after "6.1.5" "or 6.6.5"

X.2.3 = 4.1.1.9 but add after "6.1.5" "or 6.6.5"

X.2.4 = 4.1.1.2 - wording is slightly different but intent is the same, therefore no proposal to change.

X.2.5 = 4.1.1.4

X.2.6 = 4.1.1.4.1

X.2.7 = 4.1.1.5

X.2.8 = 4.1.1.6

X..2.9 = 4.1.1.7

X.2.10 = No equivalent in 4.1.1. The group propose that this should be added as 4.1.1.15 (remembering subsequent paragraphs "X.2.10 here").

X.2.11 4.1.1.15 - During carriage, large packagings should be securely fastened to or contained within the transport unit so as to prevent lateral or longitudinal movement or impact and so as to provide adequate external support.

X.2.12 - X.2.13 No equivalent in 4.1.1. The group was divided on these points but is included in this proposal for consideration by the Sub-Committee. If adopted these would need to be 4.1.1.16 and 4.1.1.17 with subsequent renumbering of the following paragraphs:

4.1.1.16 [If a large packagings has been contaminated, it shall be treated in the same manner as is required by these Recommendations for a filled large packagings unless adequate measures have been taken to nullify any hazard.

4.1.1.17 Where damaged or leaking packages are contaminated appropriate measures shall be taken to prevent excessive movement of those packages within the large packagings. When the package contains liquid sufficient material shall be added to the large packagings to absorb any free liquid].

X.2.14 = 4.1.1.14

Add a new Chapter 6.6 as set out below.

Chapter 6.6 - Requirements for the Construction and Testing of Large Packagings

6.6.1 General

6.6.1.1 Large packagings are packagings consisting of an outer packaging which contains articles or inner packagings and which

(a) Are designed for mechanical handling;

(b) Exceed 400 kg net mass / 450 litres capacity but have a volume of not more than 3000 l / 3 m^3.

The requirements of this Chapter do not apply to:

- Class 2 except articles including aerosols,

- Class 6.2 except clinical waste of UN 3291,

Class 7 packages containing radioactive material, which shall comply with the Regulations of the International Atomic Energy Agency (IAEA), except that:

(i) radioactive material possessing other dangerous properties (subsidiary risks) snall also comply with special provision 172; and

(ii) low specific activity (LSA) material and surface contaminated objects (SCO) must be carried in certain packagings defined in these Recommendations provided that the supplementary provisions set out in the IAEA Regulations are also met.

6.6.2 Code for Designating Types of Packagings

The codes used for large packagings consist of:

(a) Two Arabic numerals
50 for rigid large packagings
51 for flexible large packagings

(b) Capital letters in Latin characters indicating the nature of the material e.g. wood, steel etc. The capital letters used shall be those shown in 6.1.2.6.

6.6.3 Marking

6.6.3.1 Primary marking. Each large packaging manufactured and intended for the use according to these Recommendations shall bear durable and legible markings showing:

(a) The United Nations packaging symbol

;

For metal large packagings on which the marking is stamped or embossed, the capital letters `UN` must be applied instead of the symbol;

(b) The code "50" designating a large rigid packaging or "51" for flexible large packagings, followed by the material type in accordance with 6.5.1.4.1(b);

(c) A capital letter designating the packing group(s) for which the design type has been approved:

X for packing groups I, II and III
Y for packing groups II and III
Z for packing group III only;

(d) The month and year (last two digits) of manufacture;

(e) The State authorising the allocation of the mark; indicated by the distinguishing sign for motor vehicles in international traffic;

(f) The name or symbol of the manufacturer and other identification of the large packagings as specified by the competent authority;

(g) The stacking test load in kg. For large packagings not designed for stacking the figure "0" shall be shown;

(h) The maximum permissible gross mass or for flexible large packagings the maximum permissible load.

The primary marking required above shall be applied in the sequence of the sub-paragraphs.

6.6.3.2 Examples of the marking:

	50 A/X/05 2500/1000	96/N/PQRS	For a large steel packaging stacking load. 2500kg suitable for stacking mass1000kg.
	50 H/Y04 0/800	95/D/ABCD 987	For a large plastics packaging not suitable for stacking, gross mass 800kg.
	51H/Z/0697/S/1999 0/500		For a large flexible packaging not suitable for stacking maximum gross mass 500 kg.

6.6.4 Specific Requirements for large packagings

6.6.4.1 *Specific requirements for metal*
50A 50B 50N

6.6.4.1.1 Outer packaging shall be made of suitable ductile metal in which the weldability has been fully demonstrated. Welds shall be skillfully made and afford complete safety. Low-temperature performance shall be taken into account when appropriate.

6.6.4.1.2 Care shall be taken to avoid damage by galvanic action due to the juxtaposition of dissimilar metals.

6.6.4.2 *Specific requirements for flexible material*
51H 51M

6.6.4.2.1 Outer packaging shall be manufactured from suitable materials. The strength of the material and the construction of the flexible large packagings shall be appropriate to its capacity and its intended use.

6.6.4.2.2 All materials used in the construction of flexible large packagings of types 50M shall, after complete immersion in water for not less than 24 hours, retain at least 85% of the tensile strength as measured originally on the material conditioned to equilibrium at 67% relative humidity or less.

6.6.4.2.3 Seams shall be formed by stitching, heat sealing, glueing or any equivalent method. All stitched seam-ends shall be secured.

6.6.4.2.4 Flexible large packagings shall provide adequate resistance to ageing and to degradation caused by ultraviolet radiation or the climatic conditions, or by the substance contained, thereby rendering them appropriate to their intended use.

6.6.4.2.5 For plastics flexible large packagings where protection against ultraviolet radiation is required, it shall be provided by the addition of carbon black or other suitable pigments or inhibitors. These additives shall be compatible with the contents and remain effective throughout the life of the outer packaging. Where use is made of carbon black, pigments or inhibitors other than those used in the manufacture of the tested design type, re-testing must be waived if changes in the carbon black content, the pigment content or the inhibitor content do not adversely affect the physical properties of the material of construction.

6.6.4.2.6 Additives must be incorporated into the material of the outer packaging to improve the resistance to ageing or to serve other purposes, provided that these do not adversely affect the physical or chemical properties of the material.

6.6.4.2.7 When filled, the ratio of height to width shall be not more than 2:1.

6.6.4.2.8 Where used a liner shall be made of a suitable material. The strength of the material used and the construction of the liner shall be appropriate to the capacity of the large packagings and the intended use. Joins and closures shall be sift-proof and capable of withstanding pressures and impacts liable to occur under normal conditions of handling and transport.

6.6.4.3 *Specific requirements for Plastics*
50H

6.6.4.3.1 The outer packaging shall be manufactured from suitable plastics material of known specifications and be of adequate strength in relation to its capacity and its intended use. The material shall be adequately resistant to ageing and to degradation caused by the substance contained or, where relevant, by ultraviolet radiation. Low temperature performance shall be taken into account when appropriate. Any permeation of the substance contained shall not constitute a danger under normal conditions of transport.

6.6.4.3.2 Where protection against ultraviolet radiation is required, it shall be provided by the addition of carbon black or other suitable pigments or inhibitors. These additives shall be compatible with the contents and remain effective throughout the life of the outer packaging. Where use is made of carbon black, pigments or inhibitors other than those used in the manufacture of the tested design type, re-testing must be waived if changes in the carbon black content, the pigment content or the inhibitor content do not adversely affect the physical properties of the material of construction.

6.6.4.3.3 Additives must be incorporated in the material of the outer packaging to improve the resistance to ageing or to serve other purposes, provided that these do not adversely affect the physical or chemical properties of the material.

6.6.4.3.4 A relief device shall be fitted to each large packagings intended for the transport of liquids, capable of releasing sufficient vapour to prevent the outer packaging of the large packagings from rupturing if it is subjected to an internal pressure in excess of that for which it was hydraulically tested. This can be achieved by conventional relief devices or by other means of construction.

6.6.4.4 Specific requirements for fibreboard
50G

6.6.4 4.1 Strong and good quality solid or double-faced corrugated fibreboard (single or multiwall) shall be used, appropriate to the capacity of the large packagings and to its intended use. The water resistance of the outer surface shall be such that the increase in mass, as determined in a test carried out over a period of 30 minutes by the Cobb method of determining water absorption, is not greater than 155 g/m^2 - see ISO535:1991. It shall have proper bending qualities. Fibreboard shall be cut, creased without scoring, and slotted so as to permit assembly without cracking, surface breaks or undue bending. The fluting or corrugated fibreboard shall be firmly glued to the facings.

6.6.4.4.2 The walls, including top and bottom, shall have a minimum puncture resistance of 15 J measured according to ISO 3036:1975.

6.6.4.4.3 Manufacturing joins in the outer packaging of large packagings shall be made with an appropriate overlap and shall be taped, glued, stitched with metal staples or fastened by other means at least equally effective. Where joins are effected by gluing or taping, a water resistant adhesive shall be used. Metal staples shall pass completely through all pieces to be fastened and be formed or protected so that any inner liner cannot be abraded or punctured by them.

6.6.4.5 *Specific requirements for wood*
50D 50C

6.6.4.5.1 The strength of the materials used and the method of construction shall be appropriate to the capacity and intended use of the large packagings.

6.6.4.5.2 Natural wood shall be well seasoned, commercially dry and free from defects that would materially lessen the strength of any part of the large packagings. Each part of the large packagings shall consist of one piece or be equivalent thereto. Parts are considered equivalent to one piece when a suitable method of glued assembly is used as for instance Lindermann joint, tongue and groove joint, ship lap or rabbet joint; or butt joint with at least two corrugated metal fasteners at each joint, or when other methods at least equally effective are used.

6.6.4.5.3 Outer packaging of plywood shall be at least 3-ply. It shall be made of well seasoned rotary cut, sliced or sawn veneer, commercially dry and free from defects that would materially lessen the strength of the outer packaging. All adjacent plies shall be glued with water resistant adhesive. Other suitable materials must be used with plywood for the construction of the outer packaging.

6.6.4.5.4 Outer packaging of reconstituted wood shall be made of water resistant reconstituted wood such as hardboard, particle board or other suitable type.

6.6.4.5.5 Large packagings shall be firmly nailed or secured to corner posts or ends or be assembled by equally suitable devices.

6.6.5 Test Requirements for Large Packagings

6.6.5.1 *Performance and frequency of test*

6.6.5.1.1 The design type of each large packagings shall be tested as provided in X4.3 in accordance with procedures established by the competent authority.

6.6.5.1.2 Tests shall be successfully performed on each large packagings design type before such packaging is used. A large packagings design type is defined by the design, size, material and thickness, manner of construction and packing, but must include various surface treatments. It also includes large packagings which differ from the design type only in their lesser design height.

6.6.5.1.3 Tests shall be repeated on production samples at intervals established by the competent authority. For such tests on fibreboard large packagings, preparation at ambient conditions is considered equivalent to the provisions of 6.6.5.2.3.

6.6.5.1.4 Tests shall also be repeated after each modification which alters the design, material or manner of construction of a large packagings.

6.6.5.1.5 The competent authority must permit the selective testing of large packagings that differ only in minor respects from a tested type, e.g. smaller sizes of inner packagings or inner packagings of lower net mass; and large packagings which are produced with small reductions in external dimension(s).

6.6.5.1.6 Where a large packagings has been successfully tested with different types of inner packagings, a variety of such different inner packagings must also be assembled in this large packagings. In addition, provided an equivalent level of performance is maintained, the following variations in inner packagings are allowed without further testing of the package:

(a) Inner packagings of equivalent or smaller size must be used provided:

(i) The inner packagings are of similar design to the tested inner packagings (e.g. shape - round, rectangular, etc);

(ii) The material of construction of the inner packagings (glass, plastics, metal etc.) offers resistance to impact and stacking forces equal to or greater than that of the originally tested inner packaging;

(iii) The inner packagings have the same or smaller openings and the closure is of similar design (e.g. screw cap, friction lid, etc);

(iv) Sufficient additional cushioning material is used to take up void spaces and to prevent significant movement of the inner packagings; and

(v) Inner packagings are oriented within the large packagings in the same manner as in the tested package;

(b) A lesser number of the tested inner packagings, or of the alternative types of inner packagings identified in (a) above, must be used provided sufficient cushioning is added to fill the void space(s) and to prevent significant movement of the inner packagings.

6.6.5.1.7 The competent authority must at any time require proof, by tests in accordance with this section, that serially-produced large packagings meet the requirements of the design type tests.

6.6.5.1.8 Provided the validity of the test results is not affected and with the approval of the competent authority, several tests must be made on one sample.

6.6.5.2 *Preparation for testing*

6.6.5.2.1 Tests shall be carried out on large packagings prepared as for transport including the inner packagings or articles used. Inner packagings shall be filled to not less than 98% of their maximum capacity for liquids or 95% for solids. For large packagings where the inner packagings are designed to carry liquids and solids, separate testing is required for both liquid and solid contents. The substances in the inner packagings or the articles to be transported in the large packagings must be replaced by other material or articles except where this would invalidate the results of the tests. When other inner packagings or articles are used they shall have the same physical characteristics (mass, etc) as the inner packagings or articles to be carried. It is permissible to use additives, such as bags of lead shot, to achieve the requisite total package mass, so long as they are placed so that the test results are not affected.

6.6.5.2.2 Large packagings made of plastics materials and large packagings containing inner packagings of plastic materials - other than bags intended to contain solids or articles - shall be drop tested when the temperature of the test sample and its contents has been reduced to -18°C or lower. This conditioning must be disregarded if the materials in question are of sufficient ductility and tensile strength at low temperatures. Where test sample are prepared in this way, the conditioning in 6.6.5.2.3 must be waived. Test liquids shall be kept in the liquid state by the addition of anti-freeze if necessary.

6.6.5.2.3 Large packagings of fibreboard shall be conditioned for at least 24 hours in an atmosphere having a controlled temperature and relative humidity (r.h). There are three options, one of which shall be chosen.

The preferred atmosphere is 23 ± 2°C and 50% ± 2% r.h. The two other options are: 20 ± 2°C and 65% ± 2% r.h.; or 27 ± 2°C and 65% ± 2% r.h.

Note: *Average values shall fall within these limits. Short term fluctuations and measurement limitations must cause individual measurements to vary by up to ± 5% relative humidity without significant impairment of test reproducibility.*

6.6.5.3 *Test requirements*

6.6.5.3.1 *Bottom lift test*

6.6.5.3.1.1 Applicability

For all types of large packagings which are fitted with means of lifting from the base, as a design type test.

6.6.5.3.1.2 Preparation of large packagings for test.

The large packagings shall be loaded to 1.25 times its maximum permissible gross mass, the load being evenly distributed.

6.6.5.3.1.3 Method of testing

The large packagings shall be raised and lowered twice by a lift truck with the forks centrally positioned and spaced at three quarters of the dimension of the side of entry (unless the points of entry are fixed). The forks shall penetrate to three quarters of the direction of entry. The test shall be repeated from each possible direction of entry.

6.6.5.3.1.4 Criteria for passing the test

No permanent deformation which renders the large packagings unsafe for transport and no loss of contents.

6.6.5.3.2 *Top lift test*

6.6.5.3.2.1 Applicability

For types of large packagings which are intended to be lifted from the top and fitted with means of lifting, as a design type test.

6.6.5.3.2.2 Preparation of large packagings for test

The large packagings shall be loaded to twice its maximum permissible gross mass.

6.6.5.3.2.3 Method of testing

The large packagings shall be lifted in the manner for which it is designed until clear of the floor and maintained in that position for a period of five minutes.

6.6.5.3.2.4 Criteria for passing the test

No permanent deformation which renders the large packagings unsafe for transport and no loss of contents.

6.6.5.3.3 *Stacking test*

6.6.5.3.3.1 Applicability

For all types of large packagings which are designed to be stacked on each other, as a design type test.

6.6.5.3.3.2 Preparation of large packagings for test

The large packagings shall be filled to its maximum permissible gross mass.

6.6.5.3.3.3 Method of testing

The large packagings shall be placed on its base on level hard ground and subjected to a uniformly distributed superimposed test load (see 6.6.5.3.3.4) for a period of at least five minutes, large packagings of wood, fibreboard and plastic materials for a period of 24 h.

6.6.5.3.3.4 Calculation of superimposed test load

The load to be placed on the large packagings shall be 1.8 times the combined maximum permissible gross mass of the number of similar large packagings that must be stacked on top of the large packagings during transport.

6.6.5.3.3.5 Criteria for passing the test

No permanent deformation which renders the large packagings unsafe for transport and no loss of contents.

6.6.5.3.4 *Drop test*

6.6.5.3.4.1 Applicability

For all types of large packagings as a design type test.

6.6.5.3.4.2 Preparation of large packagings for testing

The large packagings shall be filled in accordance with 6.6.4.2.1

6.6.5.3.4.3 Method of testing

The large packagings shall be dropped onto a rigid, non-resilient, smooth, flat and horizontal surface, in such a manner as to ensure that the point of impact is that part of the base of the large packagings cnsidered to be the most vulnerable.

6.6.5.3.4.4 Drop height

Packing Group I	Packing Group II	Packing Group III
1.8m	1.2m	0.8m

Where the substances to be transported have a relative density exceeding 1.2, the drop height shall be calculated on the basis of the relative density (d) of the substance to be carried, rounded up to the first decimal, as follows:

Packing Group I	Packing Group II	Packing Group III
d × 1.5 (m)	d × 1.0 (m)	d × 0.67 (m)

6.6.5.3.4.5 Criteria for passing the test

6.6.5.3.4.5.1 The large packagings shall not exhibit any damage liable to affect safety during transport. There shall be no leakage of the filling substance from inner packaging(s) or article(s).

6.6.5.3.4.5.2 No rupture is permitted in large packagings for articles of Class 1 which would permit the spillage of loose explosive substances or articles from the large packagings.

6.6.5.3.4.5.3 Where a large packagings undergoes a drop test the sample passes the test if the entire contents are retained even if the closure is no longer sift-proof.

6.6.5.4 Certification and test report

6.6.5.4.1 In respect of each design type of large packagings a certificate and mark (as in X3) shall be issued attesting that the design type including its equipment meets the test requirements.

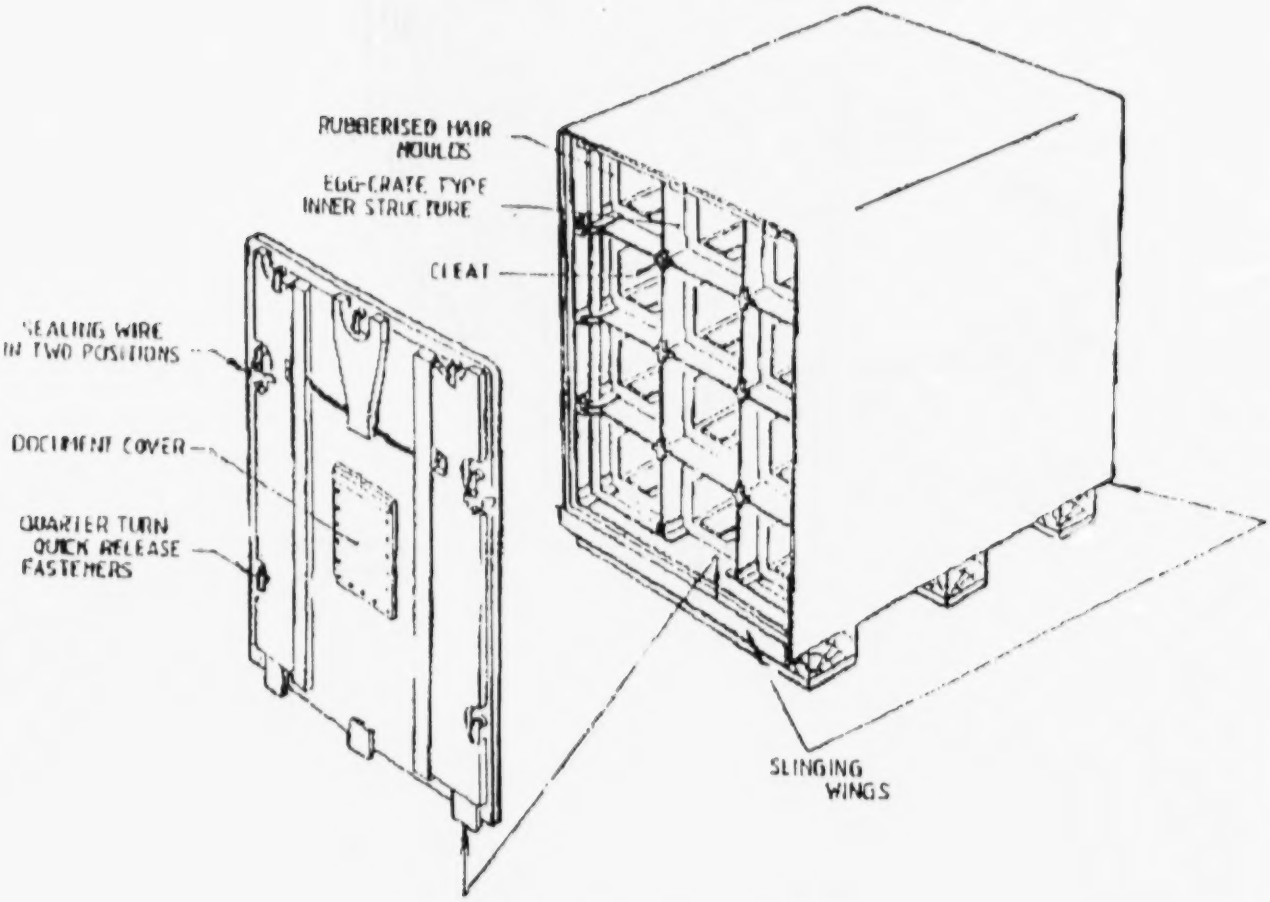
6.6.5.4.2 A test report containing at least the following particulars shall be drawn up and shall be available to the users of the large packagings:

1 Name and address of the test facility;
2 Name and address of applicant (where appropriate);
3 A unique test report identification;
4 Date of the test report;
5 Manufacturer of the large packagings;
6 Description of the large packagings design type (e.g. dimensions, materials, closures, thickness, etc) and/or photograph(s);
7 Maximum capacity;
8 Characteristics of test contents, e.g. types and descriptions of inner packagings or articles used;
9 Test descriptions and results;
10 The test report shall be signed with the name and status of the signatory.

6.6.5.4.3 The test report shall contain statements that the large packagings prepared as for transport was tested in accordance with the appropriate provisions of chapter X and that the use of other packaging methods or components must render it invalid. A copy of the test report shall be available to the competent authority.

RAOC STATISTICS PAMPHLET No 2 – SUPPLEMENT – PART 2
UNIT LOAD SPECIFICATION No 292/UNIT LOAD CONTAINER No 018

ILLUSTRATIONS



RAOC STATISTICS PAMPHLET No 2 – SUPPLEMENT – PART 2
UNIT LOAD SPECIFICATION No 141/UNIT LOAD CONTAINER No 014

ILLUSTRATIONS